Future Research

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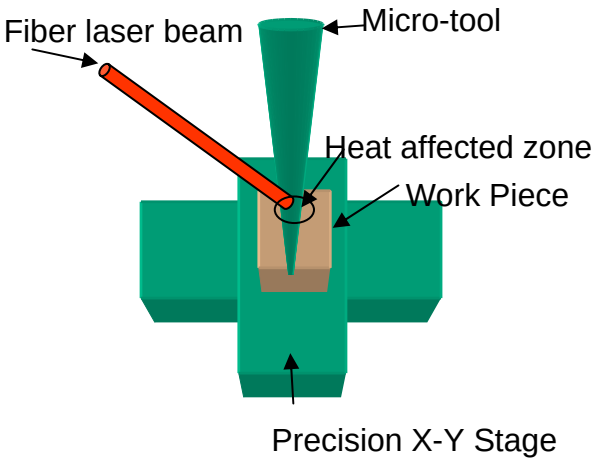
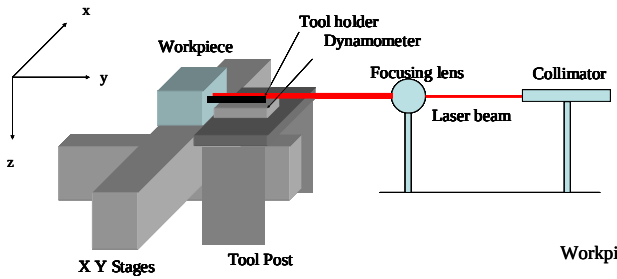
Laser Based Processes

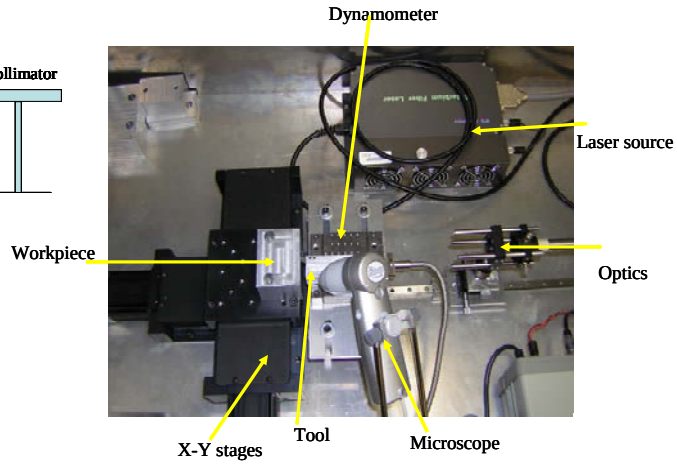
- Laser Assisted Micromechanical Machining

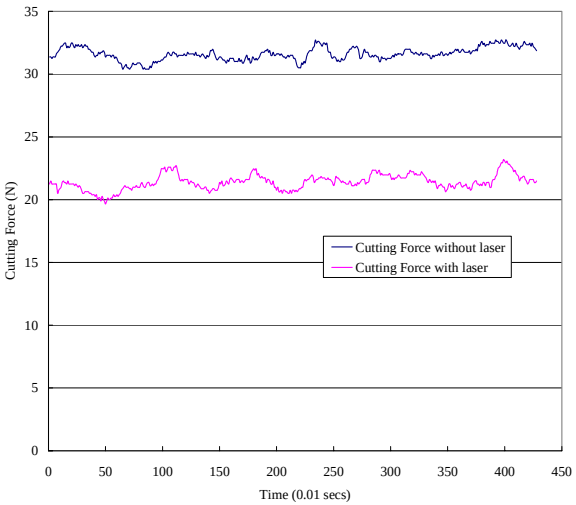
- Laser Based Surface Treatment

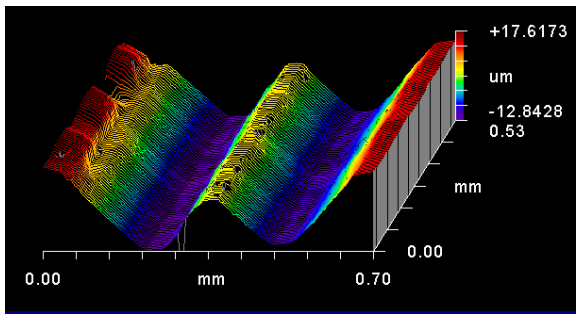
Further Development of LAMM Process

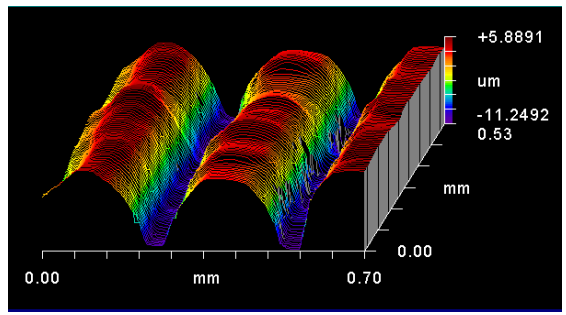












Future work:

- Apply to ceramics (Al_2O_3, Zirconia)
- Process optimization
- Extend to micro milling

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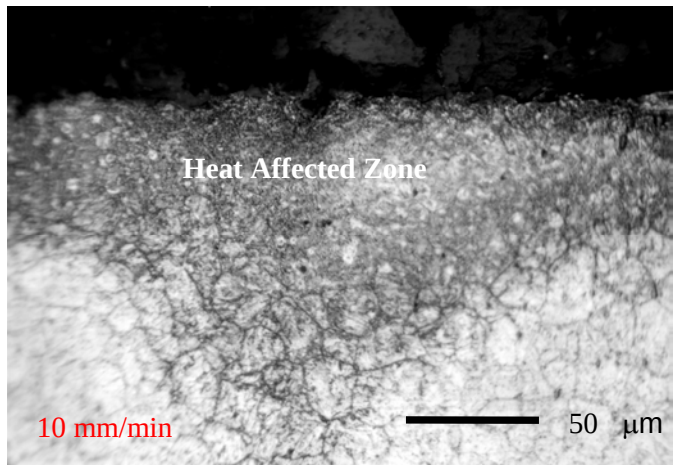
Laser Based Surface Treatment

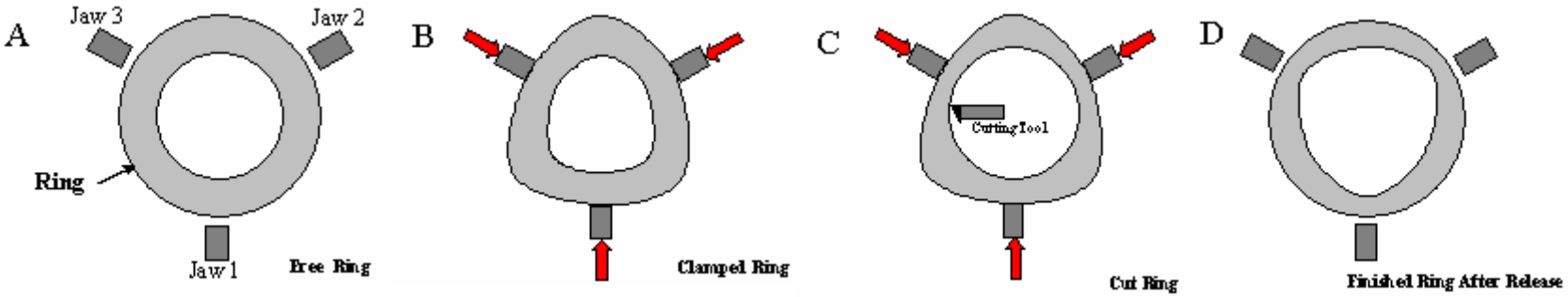
- Objective: Investigate use of continuous and pulsed lasers for surface treatment of metallic and ceramic parts
- Applications:
  - Localized alteration of microstructure and properties (hardness, residual stress, etc.)
  - Localized surface structuring for improved tribological performance
- Technical challenges:
  - Control of heat affected zone
  - Optimization of laser parameters

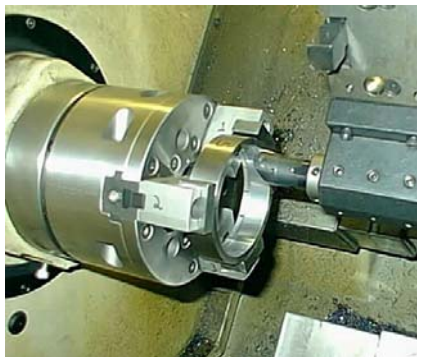


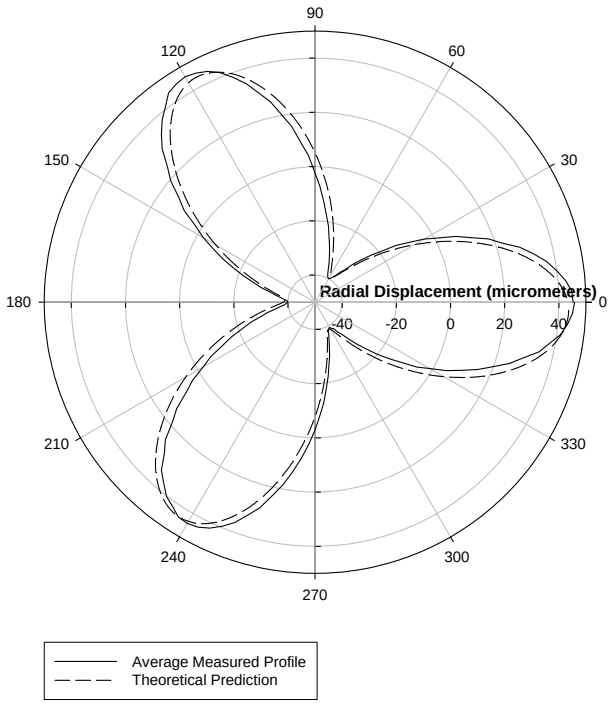
Fixturing

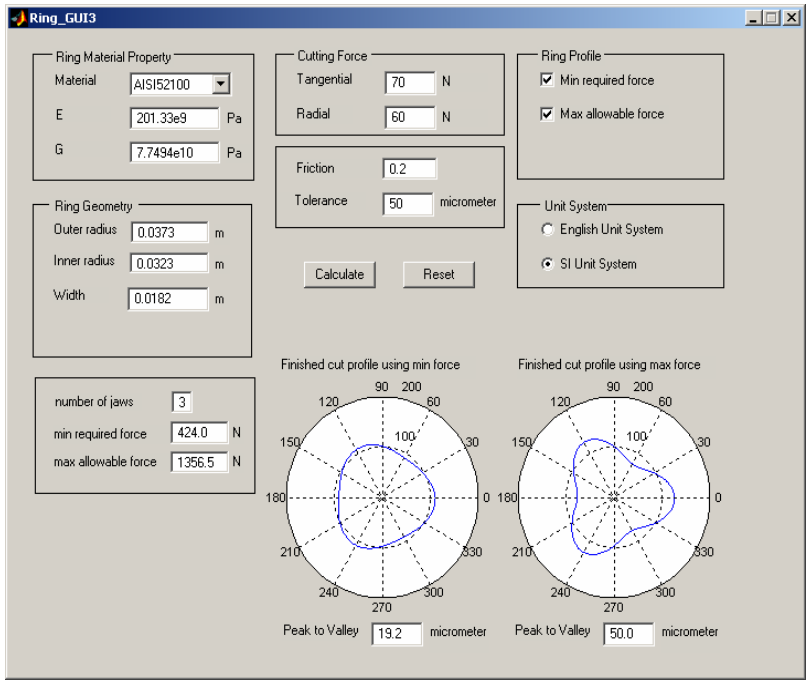
- Fixturing Analysis & Optimization for Precision Machining of Mechanical Seals

Fixturing Optimization for Precision Machining of Mechanical Seals (Sponsor: Caterpillar Precision Seals)









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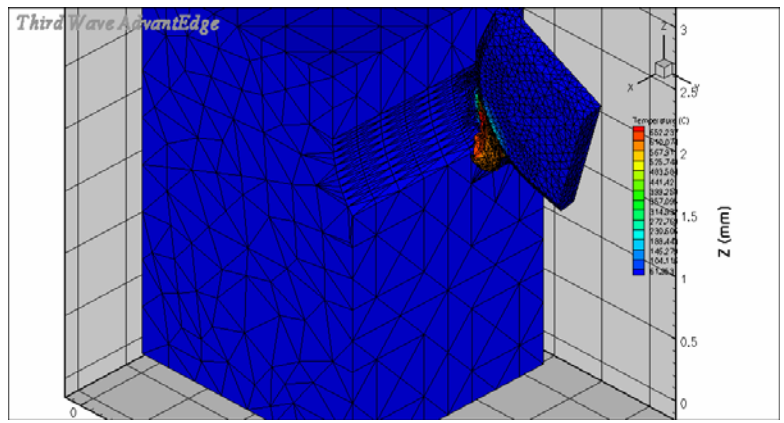
Probablistic Modeling of Machining Processes

Engineering-Statistical Modeling & Robust Optimization of Machining (with R. Joseph, J. Wu, ISYE)

- Problem: Machining process models are deterministic whereas real process has stochastic variation
- Objective: Develop engineering-statistical predictive models and robust optimization methods for machining processes
  - Account for variation in model parameters, model uncertainty
  - Application to turning, milling, etc.



- Technical challenges:
  - Formal methods for combining complex physics-based models and empirical knowledge
  - Developing efficient methods for robust optimization when using complex process models (e.g. finite element based models)